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FINAL REPORT
Electrodynamics of Body-plasma Interactions

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During the grant period, we worked on several aspects of body-plasma interactions which are:

1. Wake structure of the space shuttle, including a comparison between observations on plasma streams and theory based on plasma expansion into vacuum.
2. Spacecraft charging in response to an electron beam injection. The potential structures with and without an ambient plasma were investigated with an emphasis on the beam propagation velocity in the latter case.
3. Current collection processes in a magnetized plasma. We have developed a 2.5-dimensional($r, \theta, V_r, V_\theta, V_z$) particle-in-cell code for investigating current collection processes in a flowing magnetoplasma. This code has been applied to study the current collection properties of a long conducting cylinder for different relative orientations of the earth's magnetic field and the flow velocity vector. The plasma flow simulates the relative motion between a spacecraft and the plasma. The effects of the ram and wake due to the relative motion is self-consistently included.
4. The simulation code has been applied to study the electrodynamics of a plasma contactor based on ionization of a neutral gas cloud in the vicinity of an electrode at a relatively high positive voltage.
5. We have started and made some progress in developing a fully 3-dimensional model for body-plasma interactions.

Some reprints and preprints of papers written on the above research activities are enclosed here. It is worth pointing out that the studies in items (3) to (5) are a part of Ph. D. thesis research of Mr. B. I. Vashi. Detailed publications will be finalized as the thesis nears completion. Expected date for the completion is June, 1992.

The results from the investigations have been presented in conferences such as AGU, IEEE, AIAA and COSPAR. A list is included in the report.

During the course of this grant, we organized a workshop on Current Collection from Space Plasmas on April 24-25, 1989, at the Tom Bevil Center of the University of Alabama in Huntsville. The proceedings of the workshop are published in NASA Conference Publication 3089.